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Strategic approaches to freshwater management

Report of the Secretary-General

Contents

		Paragraphs	Page
I.	Introduction	1–2	3
II.	Problem clusters: identification of areas for action	3–15	3
	A. Access to urban and rural water supply and sanitation services	6–7	3
	B. Water for sustainable food production and rural development	8–9	4
	C. Growth in the demands and impacts of industrial use	10	4
	D. Degraded environments	11–12	4
	E. Undervalued water resources	13–14	5
	F. Weak institutional and regulatory frameworks	15	5
III.	Key issues in freshwater management: implications for policy choices and management options	16–28	5
	A. Current gaps in freshwater management	16–19	5
	1. Overall lack of awareness of the scope and function of freshwater management	16	5
	2. Absence of explicit linkages with socio-economic development	17	5
	3. Declining capacity to assess the availability and variability of water resources	18	6
	4. Mobilization of financial resources	19	6

98-01743 (E) 110298 130298

B. Implications for action: guiding principles and strategic themes 20–28

1. Integrated management as an overall approach 21–22

2. Water allocation policies to satisfy basic human needs and promote employment and income generation 23–24

3. Institutional reform: separation of policy, regulatory and operational functions 25

4. Negotiation of shared transboundary water resources 26

5. Improved information management and information flows 27

6. Progressive financing of all water-related services, including irrigation and drainage and sanitation 28

IV. Strategic actions 29–49

A. Promoting ownership and participation of key user and interest groups 30

B. Promoting productivity gains and sustainability through enhanced regulation and the use of economic instruments 31

C. Promoting sound sectoral policies and improving sectoral coordination 32–36

1. Water supply and sanitation: a major international effort towards universal coverage 33

2. Water and health 34

3. Water and food security 35

4. Water for industry 36

D. Strengthening the enabling environment 37

E. Strengthening information management and promoting the penetration and flow of key data 38

F. Management of hydro-meteorological uncertainty 39

G. Mainstreaming environmental concerns 40–43

1. Integrating land and water resources management 41

2. Protecting water quality and preventing water pollution 42

3. Incorporating freshwater management in overall ecosystem protection and management 43

H. Financing water supply and sanitation to meet basic human needs and wastewater treatment 44–47

I. Starting a process of nationally owned diagnosis and obtaining consensus and commitment 48

J. Building balanced and sustainable capacity in water management 49

I. Introduction

1. The comprehensive assessment of the freshwater resources of the world (E/CN.17/1997/9), which was submitted to the Commission on Sustainable Development at its fifth session and to the General Assembly at its nineteenth special session, concluded that currently about one third of the world's population lives in countries that are experiencing moderate-to-high water stress, and by the year 2025 as much as two thirds of the world's population could be living under similar levels of water stress. The implications for developing countries are evident from the fact that a full three quarters of the population living under conditions of moderate-to-high water stress – amounting to 26 per cent of the total world population – are located in low-to-lower middle income countries. There is reason to fear that by 2025, countries in those income categories and experiencing those levels of water stress could amount to 47 per cent of the total world population. Water stress of a different kind but just as serious is found in countries located in arid and semi-arid areas, including much of sub-Saharan Africa, which are characterized by water shortages in spite of low levels of water use even relative to low availability, due to a lack of financial resources, technical expertise and institutional support. The assessment concludes that water shortages and pollution are causing widespread public health problems, limiting economic and agricultural development and harming a wide range of ecosystems. Those problems may threaten global food supplies and lead to economic stagnation in many areas of the world. The result could be a series of local and regional water crises, with serious global implications.

2. The present report has been prepared with a view to facilitating the intergovernmental dialogue called for in paragraph 35 of the Programme for the Further Implementation of Agenda 21, which was adopted by the General Assembly in its resolution S-19/2 of 28 June 1997. The report highlights key issues requiring urgent attention, and identifies starting points for taking strategic action for sustainable development in the context of the recommendations contained in chapter 18 of Agenda 21 and emanating from other international water conferences (see also E/CN.17/1997/17/Add.1, sect. VI).

II. Problem clusters: identification of areas for action

3. Water quality is somewhat more amenable to policy choice since raw water and wastewater can be treated. In the face of a widening gap between demand and supply in terms of both quantity and quality, what is entirely determined by policy is the approach to water resource management and the subsequent planning of investment in water infrastructure. To date, most approaches at the national level have been supply led and authority over the allocation of the freshwater resources has been held ultimately by the State through declarations of public interest and the use of public funds. That style of intervention is proving unsustainable, particularly in developing countries with burgeoning populations and limited financial resources.

4. As societies' demands for water supplies grow and become more concentrated in urban areas, competition for freshwater between economic sectors is increasing in many countries, particularly in arid and semi-arid zones. Competition is particularly intense between sectors looking for large volumes of low-quality water (irrigated agriculture) and those looking for small volumes of high-quality water. Disputes over limited resources have and will continue to develop between agricultural, industrial and urban users unless water management measures to prioritize household water supply are taken.

5. The need for integration and orderly management of sectoral issues thus remains essential. Three sectoral uses stand out as being of particular importance: drinking water supply and sanitation, water for agricultural production, and the utilization of clean and efficient technologies for the use of water in industrial production. Each of those uses generates demand for a different type of water: irrigated agriculture will generally use untreated water, industry may demand bulk supplies to be treated to varying standards and water-supply business requires acceptable bulk supplies that it can then treat to potable retail standards. In addition, three principal non-sectoral issues stand out: progressively degraded hydro-environments, chronically undervalued water resource assets and serious institutional weaknesses.

A. Access to urban and rural water supply and sanitation services

6. In spite of efforts during the International Drinking Water Supply and Sanitation Decade, about 20 per cent of

the world population lacks access to safe water and about 50 per cent lacks access to adequate forms of sanitation. Current trends in the provision of services remain insufficient to achieve full service coverage in the near future. For sanitation in particular, the Water Supply and Sanitation Collaborative Council meeting held in November 1997 at Manila, the Philippines, concluded that at present rates of progress, the world cannot achieve full service coverage by the year 2100. Breakdowns in public health as a result of insufficient coverage and the poor operation and maintenance of existing water supply systems are now frequent, though rarely reported until spectacular rates of epidemiological transmission occur. The problem of water supply and sanitation is particularly acute in dense urban areas, where construction has overtaken the rate at which reticulated supply systems and sanitation services can be installed economically and within the financial capacity of municipalities. Many large towns and cities in developing countries experience chronic losses of pressure in piped water distribution systems and high leakage rates when subjected to pressure. Combined with a lack of sufficient water treatment, the ingress of polluted soil and groundwater into such systems has become a major source of water-borne disease and poses serious threats to public health.

7. Rural communities are generally well dispersed within a watershed and have intimate links with small-scale catchments and aquifers, although there is evidence that those localized sources are becoming increasingly polluted from pit latrines and waste heaps. As to the rapidly growing peri-urban communities, they remain ignored by reticulated urban systems that may have been designed many years before the location and rate of growth was anticipated. Consequently, peri-urban communities are often thrown back onto highly localized sources of water that are severely contaminated due to the concentration of habitation with rudimentary sanitation arrangements and unregulated industrial activity.

B. Water for sustainable food production and rural development

8. The water demands of irrigation schemes to satisfy grain production take up the bulk (about 85 per cent) of the world's mobilized water resources. Many schemes are operating well below their design levels because of poor operation and maintenance, as well as inequitable distribution, with tail-enders always receiving smaller allocations than designed. Lack of drainage often leads to waterlogging and salinity, taking land out of production and further degrading surface and groundwater.

9. The concept of national food security loses much of its significance in an increasingly global economy. Water resources need not necessarily be allocated to the production of food if they can be used more profitably in other sectors of the economy, thereby generating the necessary income to import food products. Accordingly, countries are striving to make a transition from food self-sufficiency, in which the country is wholly dependent on domestic production, to food self-reliance, in which both domestic and international markets are used to supply the requirements. However, the transition from an agricultural to an industrial economy needs to be carefully managed if serious social inequities and geographic dislocations are to be avoided. Rural communities in developing countries that depend on subsistence agriculture are closely linked with small first-order catchments and the water, biomass and soil resources that they contain. Such linkage dominates subsistence and economic productivity through cash crops cultivation and livestock rearing but does not tend to appear in national economic budgets until water resource availability declines and remedial intervention is required to avoid starvation and migration.

C. Growth in the demands and impacts of industrial use

10. The potential for water conservation and the use of clean technologies to manage demand and minimize the environmental impact of effluent disposal is high when industrial sectors are well regulated, with access to capital and technology. Unfortunately for many developing countries and economies in transition, the push to allow industrial sectors to grow has left environmental regulation behind. That situation, combined with a lack of access to capital and clean technology, has resulted in insignificant investment in wastewater treatment, with downstream users being forced to internalize the costs of treatment.

D. Degraded environments

11. The continued neglect of water resources requirements for ecosystems – in terms of both quantity and quality – is having devastating consequences for natural capital, aquatic biodiversity and human health. That type of breakdown is communicated down the water and sediment cascades, having an impact well beyond the original source of the

degradation and even into coastal marine environments. As pressure for farm land increases, the impact on mountain and forested areas mounts and the ability of those catchment areas to buffer runoff to watercourses and recharge areas is compromised. Superimposed on environmental degradation is the impact of climatic variability, which determines the range of hydrological responses to extreme climatic events (droughts and floods). The linkages of water to biodiversity and land degradation, particularly in arid and semi-arid zones, are also significant. In particular, groundwater plays a pivotal role in buffering the effects of drought. However, the increasing contamination of groundwater, overpumping well beyond replenishment rate, and the unplanned depletion of fossil groundwater systems are threatening many urban centres, particularly in arid and semi-arid zones.

12. The balance between environment and development needs to be founded on a clear understanding of the environmental systems and the resources that they can furnish without compromising their overall long-term integrity. The economic implications of environmental degradation and ignorance of climatic variability can account for significant percentages of gross domestic product in lost productivity. However, their direct costs are often internalized by downstream users and their long-term economic implications (including *in situ* values) and over-utilization are rarely factored into long-term marginal costing for investment in infrastructure.

E. Undervalued water resources

13. The economics of water resources rarely influence water policy, even in water-short regions. As a result, the principal asset – the water resource base – remains highly undervalued and readily used without much concern for its value to others, the structural role of water in the economy and its *in situ* value as an environmental asset.

14. Although many countries have policies that prioritize categories of water use, particularly in times of shortage, very few have implemented regulations or incentives designed systematically to use water in an economically efficient manner. Water tariffs rarely reflect long-run marginal costs, let alone full economic pricing, including opportunity costs and pollution charges. Consequently, all types of water remain undervalued in economic terms and the associated water services severely underpriced. That miscalculation continues to result in profligate use within some sectors – notably agriculture – and chronic shortages to meet basic human needs. More importantly, there is no clear economic signal sent to competing sectoral users or to the state organizations responsible for regulating freshwater resource use and allocating resources among economic sectors.

F. Weak institutional and regulatory frameworks

15. Water institutions in many developed and developing countries remain relatively weak, unable to command regular budget allocations and deprived of the policy instruments and management tools to implement sound water management. The failure of institutions to implement progressive policies is often linked as much to a lack of public awareness and consensus as to lack of financial resources. In reaching out to diverse and diffuse national populations, even well crafted technocratic solutions have failed to make the expected impacts when not accompanied by serious attempts to involve consumers in urban and rural areas. Many spatial disparities are evident at subnational levels, with remote regions and districts lagging behind the central zones of economic activity in terms of water service provision. The weakness is reinforced by the tendency to mix policy-making, regulation and operational functions in single institutions.

III. Key issues in freshwater management: implications for policy choices and management options

A. Current gaps in freshwater management

1. Overall lack of awareness of the scope and function of freshwater management

16. Overall awareness of the hydro-environmental limits to water resource mobilization is generally poor. Political commitment and public education to promote resource protection and conservation – except in countries with limited options – is inadequate. Indeed, awareness of water issues is usually only heightened in times of extreme shortage or dramatic degradation in quality, with little attention given to long-term preventive measures.

2. Absence of explicit linkages with socio-economic development

17. The explicit linking of water issues to human development and economic productivity is generally lacking

both in terms of national policy declarations and supporting legislative and administrative support. One of the most important consequences of that gap is the extremely low importance attached to the integration of physical and socio-economic information.

3. Declining capacity to assess the availability and variability of water resources

18. The effective assessment and management of water resources, including the prevention and mitigation of water-related disasters, is not possible without adequate physical and socio-economic information flows. Yet the capability to provide accurate water quality and quantity data is deficient in many countries. For years, the capacity of hydrological offices in developing countries, particularly in Africa, has been declining in terms of operation and maintenance and the extent of hydrologic networks. Few, if any, developing countries have a significant capability for water quality monitoring. In addition, the fragmentation of national organizations dealing with water resources assessment and the lack of integration of hydrological and land-use data, as well as of economic and demographic data, severely limit the usefulness of existing information. The possibility of climate change increases uncertainty concerning the variability in the distribution of water resources. The trends in hydro-environmental behaviour induced by climatic variability and current consumption patterns are now posing unprecedented problems for water resource managers, making their tasks increasingly complex.

4. Mobilization of financial resources

19. The mobilization of financial resources to develop, utilize and manage water resources is lagging behind actual sectoral needs. The annual total investments required for the effective assessment, development and utilization of water resources, including wastewater treatment, greatly exceed the capacity of Governments and the international community under current patterns of financing. According to the World Bank, the overall level of current investment in water-related infrastructure in developing countries amounts to US$ 75 billion annually, with about US$ 15 billion being allocated for hydropower, US$ 35 billion for irrigation and drainage, and US$ 25 billion for water supply and sanitation. The financial resources necessary to achieve full water supply and sanitation coverage by the year 2000 are estimated to be more than three times the current rate of expenditure. It is also proving very difficult to mobilize financial resources for investment in wastewater treatment and this will continue to limit improvements in water quality. It is now clear that whatever approaches to regional and local government are taken, Governments will never be in a position to extend more services to local underserved population groups from government budgets alone. And although external support agencies have and will continue to play an important role in generating financial resources, that contribution will constitute only a small percentage of the total requirements. Only the adoption of pricing policies geared towards cost recovery will enable the public and private sectors to generate the financial resources needed for capital investment and for operation and maintenance.

B. Implications for action: guiding principles and strategic themes

20. Strategic approaches to freshwater management need to be based on a set of principles if they are to work progressively towards the goals of equity and sustainability. Those principles and themes have evolved since the United Nations Water Conference held at Mar del Plata, Argentina, in 1977, through the ensuing set of international conferences, including the 1990 New Delhi Global Consultation on Safe Water and Sanitation, the 1992 Dublin International Conference on Water and the Environment, the subsequent elaboration in chapter 18 of Agenda 21 by the United Nations Conference on Environment and Development and the 1994 Noordwijk Ministerial Conference on Drinking Water and Environmental Sanitation, and now offer a guiding framework upon which specific actions can be based. In addition, those principles were reinforced or elaborated by other major recent United Nations conferences, including the Global Conference on the Sustainable Development of Small Island Developing States, held at Bridgetown, Barbados, in 1994; the World Summit for Social Development, held at Copenhagen in 1995; the United Nations Conference on Human Settlements (Habitat II), held at Istanbul in June 1996; and the World Food Summit, held in Rome in November 1996. Those principles are summarized below.

1. Integrated management as an overall approach

21. Integration of all water-related activities through a mix of institutional and economic instruments is a key requirement for addressing the goals of social welfare, environmental integrity and economic productivity. In striving to reconcile socio-economic demands with available resources, three fundamental areas of action may be recognized: (a) the pivotal role of participation and the principle of subsidiarity, (b) the role of economics and financing in driving productivity gains, and (c) the need to

protect hydro-environmental integrity and recognize environmental limits. Addressing specific water issues under each of these areas requires awareness and political commitment. Awareness-raising must be matched by incentives to change. Clear economic signals may do some of this by, for example, informing consumers of current and future costs or by indicating levels of profligate use. If it is to be effective at all, a carefully orchestrated initiative of public education, pricing policy and engagement of consumer and interest groups needs to be considered.

22. An open, transparent and continuous process of consultation and participation is essential if national water resources are to be managed in an equitable and sustainable fashion and resources found to extend water services to those currently deprived of access to water and sanitation. The role of regional and central government as policy maker and provider of technical support must be complemented by local (district level) government action as a mobilizer or promoter of community-based management to yield positive results in terms of health, income generation and environmental protection.

2. Water allocation policies to satisfy basic human needs and promote employment and income generation

23. Failure to adapt to the finite nature of water as a resource and to recognize its social and economic value is leading to haphazard sectoral allocations in water, as well as suboptimal impacts on employment and income generation and the satisfaction of basic needs. An integrated approach to the efficient and equitable development and allocation of water resources requires the use of economic and regulatory instruments designed to maximize social net benefits. The use of market and non-market instruments to allocate water resources has received much attention in recent years. Although administrative solutions and the rigorous application of laws and regulations are more commonly used to allocate water, market mechanisms are increasingly being introduced. The pricing of bulk and retail water at somewhere near the long-term marginal cost is becoming inevitable as subsidies become unrealistic or are no longer found to be acceptable. Nevertheless, in setting up tariffs, there is a need to accommodate those sectors of the population that cannot afford minimum levels of services. Pollution charges send economic signals to users, encouraging wastewater treatment and reuse. Informal markets in both bulk water and water services are used by many rural economies in which transactions between neighbouring farmers and transient demands and supplies (agro-pastoral communities, for example) are arranged. Such markets occur in an unstructured way and can involve a degree of self-regulation, particularly in semi-arid zones with long dry seasons. In some circumstances, informal groundwater markets are proving unsustainable as farmers seek to maximize agricultural output in the short run. Formal market mechanisms have been used under special circumstances in which infrastructure and regulation allow the marketing of user rights and where the sectoral competition is severe, such as between the agricultural and urban sectors in California or in the case of Chile.

24. Regulatory and economic instruments also need to be designed to maintain the overall stock of environmental assets linked to freshwater. It is incumbent upon the international community to demonstrate the full range of tools that can be used to allow national policy makers to select those that are most appropriate and for the use of which consensus can be obtained. As countries review their water legislation, the first thing that is usually examined is enhanced regulation and enforcement. However, the resources are rarely available to enforce detailed regulations and standards. Legal and institutional arrangements can perform an important enabling function since they may significantly influence the manner in which individuals, institutions and enterprises relate to natural resources. Equally, the recognition of customary uses and water rights can enhance trust in government activities and programmes. Allowing socially and environmentally acceptable transfers of water and land rights may also encourage more productive uses.

3. Institutional reform: separation of policy, regulatory and operational functions

25. The drive towards integrated management might suggest the need for a government authority responsible for all aspects of the hydrological cycle. However, experience with water resource management demonstrates the need for a clear separation of policy, regulation and operational functions, the commercial autonomy of water service utilities, and for adapting existing arrangements to promote integrated water resources management at a technical level. For that to happen, a policy dialogue to adapt mandates and responsibilities has to be initiated. Despite the common perception that the water utility business is currently being deregulated as state monopolies are commercialized or privatized, there is a need to reregulate to allow private actors and financially autonomous water utilities to engage in a fair and transparent commercial environment and protect public and environmental interests.

4. Negotiation of shared transboundary water resources

26. The recently agreed Convention on the Law of the Non-Navigational Uses of International Watercourses (see A/51/869) as well as existing regional agreements and conventions provide the basis of negotiation. By addressing individual national priorities within the framework of those recommendations, it is expected that individual countries can work towards mutually beneficial sharing arrangements. Sharing key sets of data and agreeing on social and economic principles often prove essential in making progress in such negotiations.

5. Improved information management and information flows

27. The demand for linked hydrological and socio-economic information needs to be clearly established if information gathering systems are to receive sufficient support. Relevant and detailed hydrological and socio-economic information is as much for planners and managers as for policy makers and water users, and an adequate flow of information is needed to alert planners to trends and potential gaps.

6. Progressive financing of all water-related services, including irrigation and drainage and sanitation

28. The financing of water (including irrigation and drainage) and sanitation services can no longer be assumed to be an exclusive role of the State, even though the public interest in water and sanitation services is high. There is clearly a great scope for the improvement of cost recovery in water infrastructure and demand management of water use at the national level. Governments and communities are turning to alternative actors, such as autonomous public utilities, large multinational companies who are prepared to invest in urban infrastructure or small village communities committed to improving their use and management of limited water resources, to contribute capital and expertise. As the fiscal pressure mounts for the State to withdraw from direct investment in water services, the transfer of operational responsibility and ownership to various user groups requires careful planning. For larger-scale investments in flood control, hydropower and municipal supplies and wastewater treatment, State-controlled corporations or State-guaranteed support contracts to the private sector have become necessary. Lessons learned from the uneven success of such public-private partnerships have led to improvements in the forms and methods of partnership and to the recognition of the need for adequate regulation. This calls for a fresh examination of the role of economic instruments, the contribution of consultative and participatory processes, the enabling functions of legislation and customary law and a fundamental appreciation of the value of the physical processes that bind hydro-environmental systems.

IV. Strategic actions

29. In dealing with a resource in which the public interest is high and whose environmental role is vital, certain principles of equity, transparency, efficiency and sustainability should be respected. There is a need to identify the starting points in a process of adaptation so that well informed policy choices and management options can be taken at the local, national and regional levels. This process of adaptation and innovation is an iterative process that needs constant revision as environmental and socio-economic changes take place. It also needs to be able to reconcile long-term visions for water management with short-term realities that apply in specific countries and regions.

A. Promoting ownership and participation of key user and interest groups

30. The engagement of key user and interest groups, including women, in rural and peri-urban zones, municipalities, farmers, industrialists and non-governmental organizations is necessary if such stakeholders are to play their respective roles in progressive freshwater management. If Governments are to disengage from the centralized provision of services, then the burden of responsibility for financing, operation and maintenance of water infrastructure falls to the user groups. Conditions for such participation requires the clear identification of the actors, their rights and responsibilities in relation to water. This will usually require the formulation of a water code and a parallel process of open consultation and engagement of stakeholders through public forums and meetings.

B. Promoting productivity gains and sustainability through enhanced regulation and the use of economic instruments

31. The joint use of regulatory and economic instruments needs to be promoted to create the conditions for the productive and sustainable engagement of all economic agents. Identifying stable water user rights and permitting their transfer on open markets, subject to tests of beneficial use, may be one way to formalize currently unstructured water trading and create opportunities for productivity gains through a more efficient use of land and water resources. Formal negotiation and trading in water and pollution at the basin level among industry, municipalities and rural communities and users upstream and downstream is more complex, but can be started once a clear picture of environmental constraints and economic opportunities is drawn up. Since most economies can no longer afford to supply bulk and retail water in simple response to demand, demand management will become more important. Water efficiency gains in irrigated agriculture offer the best opportunity for reducing demand for bulk water and high-quality groundwater. Here, issues of land tenure and water user rights need to be addressed in designing policy reforms.

C. Promoting sound sectoral policies and improving sectoral coordination

32. Sectoral imperatives need to be addressed within an integrated framework, but the implementation of innovative strategic approaches will occur within well defined sectoral limits. The types of key sectoral actions that can be considered are set out below.

1. Water supply and sanitation: a major international effort towards universal coverage

33. As we look towards the start of the twenty-first century, it has become painfully evident that nothing short of a major initiative at the national, regional and global levels will lead towards achieving the ultimate objective of full water supply coverage in the early years of the new century and generate the needed momentum towards the provision of basic sanitation services. A starting point is the speedy implementation of the recommendations contained in the Action Programme of the Noordwijk Ministerial Conference on Drinking Water and Environmental Sanitation. Particular attention is drawn to the Conference's recommendation concerning the need to undertake resources assessments to produce an inventory of the current situation, and to identify problems and constraints in providing water supply and environmental sanitation services. The Conference also recommended the development, review or revision, by 1997, and the implementation in the context of national sustainable development strategies, consistent with Agenda 21, of measures for drinking water and environmental sanitation, taking into account the goals set by the World Summit for Children. The Forward Looking Assessment on the Implementation of the Action Programme on Drinking Water and Environmental Sanitation (see E/CN.17/1997/15) urged countries to review their policies, giving increased priority to improving sanitation services and focusing on five key components of sustainability (social, environmental, institutional, financial and technical). Specific actions recommended in this area include:

(a) At the national level:

(i) Promotion of participation of local communities, including women and the poor, and user groups;

(ii) Development of urban and rural development strategies for improving the incomes of the urban, peri-urban and rural poor, together with the provision of improved water supply and sanitation services;

(iii) Promotion of partnerships between the public and private sectors, and between national and local institutions;

(iv) Development of strategic approaches for the provision of adequate financial resources for water supply and sanitation improvements, including economic mechanisms for promoting efficient water use and cost recovery.

(b) At the regional and global levels:

(i) Strengthening of regional and international cooperation for the exchange of information on national experiences in water supply and sanitation improvements, by establishing or strengthening clearing house mechanisms to promote the sharing of successful experiences and water technologies;

(ii) Assistance to Governments, at their request, in creating an enabling institutional and legislative environment for the effective contribution of public and private utilities to the provision of water supply and sanitation to urban and rural communities.

2. Water and health

34. With water a primary agent in maintaining human health and transmitting disease, the imperative remains to

manage all freshwater sources to maintain chemical and biological quality within minimum acceptable standards. This can only be realized if adequate attention is paid to the treatment and management of wastewater from all sectors. Key actions that will work towards protection and improvement of water quality include:

(a) At the national level:

(i) Priority for sanitation, including the provision of safe excreta disposal services at relatively low cost, and education on personal hygiene;

(ii) Mitigation and disaster preparedness in order to ensure prompt action to limit adverse effects on health.

(b) At the regional and global levels:

(i) Monitoring of bacteriological and parasitic water-borne diseases at the basin level;

(ii) Prevention or minimization of the contamination of water by heavy metals and other chemicals.

3. Water and food security

35. The management and use of water resources for agriculture needs to be seen in the context of competing demands for the resources, and of the fact that more than 500 million people throughout the world, particularly in developing countries, do not have enough food to meet their basic nutritional needs. In pledging their political will and their common national commitment to achieving food security for all and an ongoing effort to eradicate hunger in all countries, the participants at the 1996 World Food Summit stressed the need to achieve increased food production, including staple food, within the framework of the sustainable management of natural resources and the eradication of poverty. There is a clear imperative to improve the efficiency of water use in irrigated agriculture and to assess the opportunity cost of continuing such large allocations to the sector. The sector maintains a strong programme of international research and development in water use, but the economic benefit from the allocation to the sector needs to be re-evaluated in a broader, cross-sectoral perspective. To do so, key actions recommended include:

(a) At the national level:

(i) Promotion of policy reviews about the amount of water countries allocated for food production as compared to other uses, taking into consideration trade options of food in the global market;

(ii) Introduction of measures to improve the technical efficiency of agricultural water use, including close monitoring of irrigation system performance, re-use of wastewater and promotion of adaptive technological research and development;

(iii) Promotion of environmentally sound aquaculture;

(iv) Consideration of adequate policy mixes, including market incentives to reduce wastage, promote stakeholder participation and use water resources development to reduce poverty;

(v) Development of integrated approaches to water use in rainfed and irrigated agriculture;

(vi) Promotion of efficient water allocation, including charging systems for efficient water use, cost recovery policies to provide secure sustained efficient operations and maintenance of irrigation systems, taking into account the satisfaction of basic human needs and global food security.

(b) At the regional and global levels:

(i) Promotion of regional cooperation for food production and trade;

(ii) Promotion of a clearing house mechanism for sharing successful experience and technologies in the provision of water resources for food production.

4. Water for industry

36. As industrial demand grows and pressure for a modification of intersectoral allocations mounts, the need to pre-empt growth in chemical pollution will become more and more apparent. Key actions that need to be considered in regulating industrial use include:

(a) Promotion of clean technologies through information, regulation and incentives;

(b) Promotion of environmental auditing within specific industrial sectors;

(c) Formulation and implementation of economic instruments, such as pollution charges and incentives for introduction of cleaner technologies.

D. Strengthening the enabling environment

37. As stressed in the report of the 1992 International Conference on Water and the Environment, recognizing the need for a central mechanism capable of ensuring the coordination of national, social and economic interests, the role of Governments needs to be reviewed to ensure that

users, local institutions and the formal and informal private sector can play a more direct part. A key aim must be to improve accountability to the public. The levels at which management decisions can be taken and problems solved will vary widely from country to country and case to case. In any given situation, however, water resources should be managed at the lowest appropriate levels. Specific actions recommended include:

(a) At the national level:

(i) Review of existing institutional arrangements with a view to determining the existence of institutional fragmentation and to ensuring proper linkages with socio-economic decision-making processes;

(ii) Clarification of legislation concerning land and water rights, taking into account customary law;

(iii) Development of regulatory frameworks, providing an enabling environment for the effective participation of the public and private sectors.

(b) At the regional and global levels:

(i) Cooperation among international watercourse States in their harmonious development;

(ii) Promotion of regional water resources development and use strategies in the context of regional economic and social development policies and strategies.

E. Strengthening information management and promoting the penetration and flow of key data

38. A clear rationale for strengthening information management must be made. The respective technical and economic departments and government agencies may be able to start combining data sets with existing resources through regular collaborative meetings and exchanges, but need to be given clear reasons and instructions for doing so. Establishing the demand for data to justify an adequate provision of flow of financial resources may need to involve the proactive marketing of data to key decision makers. Specific actions recommended in this area include:

(a) At the national level:

(i) Assessment of existing data collection and information management systems to ensure that they meet management and decision-making requirements, are cost-effective and client-oriented;

(ii) Strengthening or development of strategic approaches to data gathering and requirements, in terms of water quantity and quality (both surface and groundwater) and water use, in relation to national, regional and local developmental and environmental objectives;

(iii) Establishment of information management systems capable of integrating, analysing and disseminating physical and socio-economic data for decision-making;

(iv) Strengthening of local capacity and participation in monitoring and assessing water resources in order to enable local people and decision makers to understand the options available for development.

(b) At the regional and global levels:

(i) Establishment of regional data, research and training centres in support of national requirements and for the monitoring and analysis of regional issues concerning the sustainable development of water resources;

(ii) Strengthening global water information networks to compile data on water quality and quantity and water use, and to support ongoing efforts in the collection and dissemination of data and information as related to integrated river basin management;

(iii) Assistance by industrialized countries, international organizations and aid agencies in the transfer of information management technology and evaluation of observational networks, and assistance in capacity-building in developing countries and economies in transition;

(iv) Periodic updating by the United Nations agencies, in cooperation with other organizations, including non-governmental organizations, of comprehensive global and regional assessments of freshwater resources.

F. Management of hydro-meteorological uncertainty

39. The need to cope with hydro-meteorological extremes and climatological shifts requires clear operational and planning guidelines based on present understanding of events and reasoned projections. The key actions that can be recommended are:

(a) At the national level:

(i) Implementation of national drought management strategies;

(ii) Formulation or updating of flood protection operational guidelines;

(iii) Formulation and execution of measures to protect the integrity of land and water ecosystems, in particular in the case of small island developing States.

(b) At the regional and global levels:

(i) Promotion of integrated basin drought and flood management strategies;

(ii) Mobilization of resources for data gathering and analysis;

(iii) Assessment of possible impacts of climate change.

G. Mainstreaming environmental concerns

40. The explicit incorporation of freshwater management in overall environmental policy is critical to maintain the stock of environmental assets and associated economic and environmental services, and should include the following set of thematic interventions.

1. Integrating land and water resources management

41. Specific actions recommended include:

(a) At the national level:

(i) Promotion of integrated land and water management within the framework of national development plans, and study the linkages between regional economic development programmes and integrated river basin management;

(ii) Control of the use of fertilizers and pesticides to minimize non-point pollution sources and promote integrated pest management through appropriate regulatory and economic instruments.

(b) At the regional and global levels:

(i) Development of river basin action plans, especially for high-priority risk basins, including their rivers, lakes and aquifers, to integrate land-use planning, especially in upstream regions, with water management and conservation; coordinate the activities of provincial, national and international agencies; and address transboundary issues;

(ii) Support for the implementation of the United Nations Convention to Combat Desertification, in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa; the Convention on Biological Diversity; and the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention).

2. Protecting water quality and preventing water pollution

42. Specific actions recommended include:

(a) At the national level:

(i) Promotion of economic mechanisms based upon the polluter-pays principle;

(ii) Strengthening or promotion of local participation in pollution control efforts;

(iii) Formulation and implementation of basin action plans to address transboundary pollution issues and to initiate contingency plans to control accidental spills;

(iv) Promotion of integrated approach to quantity and quality components of water resources management;

(v) Integration of land-use management and sustainable water management.

(b) At the regional and global levels:

(i) Establishment of links to the recommendations of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities;

(ii) Recognition of freshwater, coastal and marine environments as a management continuum;

(iii) Implementation of actions to protect upstream areas (mountains and forests) in order to preserve water quality downstream, recognizing the important link between land management and water quality.

3. Incorporating freshwater management in overall ecosystem protection and management

43. Specific actions recommended include:

(a) At the national level:

(i) Promotion of national environmental valuation and accounting;

(ii) Assessment of the water requirements of natural systems, including wetlands, to maintain integrity for sustained productivity;

(iii) Formulation of strategic action plans for the protection and management of aquatic ecosystems, within the framework of the conventions on biological diversity and desertification, the Ramsar Convention and the Global Environment Fund operational programmes;

(iv) Promotion of local involvement in efforts to protect ecosystems.

(b) At the global and regional levels:

(i) Strengthening of regional cooperation in efforts to protect ecosystems of transboundary rivers, lakes and wetlands;

(ii) International cooperation to promote water conservation and recycling, pollution prevention and control, and environmentally sound agricultural and industrial practices.

H. Financing water supply and sanitation to meet basic human needs and wastewater treatment

44. It is clear that the overall level of current investment in water infrastructure is insufficient to meet basic human needs and acceptable levels of socio-economic development. As mentioned above, the current rate of expenditure in water supply and sanitation is estimated to be only a third of the amount required to achieve full coverage. While official development assistance (ODA) is an important source of water sector finance in the poorest countries, in most developing countries the bulk of investments required to develop, upgrade or maintain water resources infrastructure will have to come from national sources. In order for that to happen Governments need to foster an enabling environment that encourages investments from both public and private sources, and to formulate and implement pricing policies for greater cost recovery, efficient allocation of water and water conservation, taking into account the country's level of development. In addition, Governments need to allocate a significantly higher proportion of their budget expenditures to public investments in water supply and sanitation with a view to increasing the rate of coverage considerably. That is particularly true in the case of sanitation (and sewage treatment), which is not only lagging behind water supply coverage but also has more limited opportunities for cost recovery.

45. Nonetheless, given the insufficient rate of investment in water-related infrastructure in developing countries, and as clearly stated in the Programme for the Further Implementation of Agenda 21 (see General Assembly resolution S-19/2, annex), ODA remains an important source of external funding for many developing countries, particularly the least developed countries. It can thus be considered as essential for the effective implementation of Agenda 21 since it cannot always be replaced by private capital flows. ODA can play an important complementary and catalytic role in promoting economic growth, and may in some cases play a catalytic role in encouraging private investment and – where appropriate – all aspects of country-driven capacity-building and strengthening.

46. The 20/20 initiative agreed upon at the World Summit for Social Development at Copenhagen called for an agreement on a mutual commitment between interested industrialized and developing country partners to allocate, on average, 20 per cent of ODA and 20 per cent of the national budget, respectively, to basic social services, including water supply and sanitation. Current United Nations Children's Fund estimates suggests that developing countries, on average, are spending only about 13 per cent of government budgets on basic social services, and that about 10 per cent of ODA is spent on basic social services. There are many opportunities for innovative financing arrangements for water development, with risks spread among a broader range of beneficiaries and stakeholders. A move towards full cost recovery by guaranteeing the commercial and managerial autonomy of water services is one essential element of financially sustainability. The key actions in that process are:

(a) At the national level:

(i) Identification of all potential actors at local and regional levels to ensure that all possible sources of expertise and finance can be tapped;

(ii) Strengthening of the role of the Government at various levels, as a provider of development financing for specific development projects and as a provider or guarantor of credits to public and private ventures;

(iii) Development of criteria and approaches to pricing policies related to the provision of water resources and demand management, taking into account basic human needs, cost recovery requirements, allocation efficiency, internalization of environmental costs and benefits, and other socio-economic considerations;

(iv) Development of public-private partnerships to improve efficiency of water provision and to tap private investments for the expansion or improvement of water infrastructure.

(b) At the regional and global levels:

(i) Fulfilment by industrialized countries of their commitments to reach the accepted United Nations target of 0.7 per cent of gross national product as soon as possible;

(ii) Formulation of regional financing strategies, involving regional financial organizations in partnership with other international organizations and the private sector;

(iii) Coordination of international financial resource flows in the form of direct grants and loans in concessional terms to developing countries, in particular the least developed countries, in addition to the mobilization of the private sector.

47. Mobilizing finance for wastewater treatment can be initiated not only through punitive environmental and public health regulation but also through the imaginative use of information exchange and partnering with communities, municipalities and industry. New low-cost techniques for small-scale sewerage and treatment are currently available, including the use of pond systems. For industry, net savings may be possible if relatively small investments are made in clean technologies. In water-scarce regions, municipalities may be able to enter into wastewater reuse profitably if pricing policies reflect long-run marginal costs.

I. Starting a process of nationally owned diagnosis and obtaining consensus and commitment

48. A compelling case for the integration of water management into the national development process and cross-sectoral programme formulation must be made at a high level and endorsed at all levels. The first step for such an initiative may be a diagnostic assessment of current physical and socio-economic circumstances surrounding water, predictions of trends in consumption patterns and the formulation of feasible solutions. Such a start needs to be nationally owned and internalized if it is to lead to sustained national commitment to change and reform. External support from specialized United Nations agencies, multilateral agencies, bilateral agencies and international non-governmental organizations can be sought when they are able to support the process financially and offer specific advice and peer review in their areas of comparative advantage.

J. Build balanced and sustainable capacity in water management

49. The water managers of the future will have to be much more multidisciplinary to cope with new policy agendas and operational procedures. Not only the traditional hydrologists and hydraulic engineers but also biologists, accountants, environmentalists, economists and social scientists will all have important roles to play in advancing sustainable freshwater management. Key steps in building such capacity are:

(a) Assessment of present and future national capacities in the above broad range of disciplines, and specification of future training needs;

(b) Implementation of a long-term training programme to keep a critical stock of human resources in place;

(c) Establishment of human resources management programmes for enhancing employment opportunities and remunerating water management professionals in line with other sector professionals.